भारतीय मानक
Indian Standard

IS 6313 (Part 2) : 2022

भवनों में दीमक-अवरोधक उपचार — रीति संहिता

भाग 2 निर्माण से पूर्व रासायनिक उपचार

(चौथा पुनरीक्षण)

Anti-termite Measures in Buildings — Code of Practice

Part 2 Pre-Constructional Chemical Treatment Measures

(Fourth Revision)

ICS 91.120.99

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

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FOREWORD

This Indian Standard (Part 2) (Fourth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Building Construction Practices Sectional Committee, had been approved by the Civil Engineering Division Council.

Termite control in buildings is very important as the damage likely to be caused by the termites is huge. Wood is one of the cellulosic material which is damaged by termites whose basic nutrient is cellulose. Termites also damage materials of organic origin with a cellulosic base, household articles like furniture, furnishings, clothing, stationery, etc. Termites are also known to damage non-cellulosic substances in their search for food. Rubber, leather, plastics, neoprene as well as lead coating used for covering of underground cables are damaged by termites. The widespread damage by termites and high constructional cost of buildings have necessitated evolving suitable measures for preventing access of termites to buildings.

On the basis of their habitat, termites are divided into two types, namely

(a) subterranean or ground nesting termites, and

(b) non-subterranean or wood nesting termites having no contact with soil (*see* Annex B).

The subterranean termites are most destructive and are mainly responsible for the damage caused in buildings. Typically, they form nests or colonies underground in the soil, near ground level in a stump or in other suitable piece of timber, and some species may construct a conical or dome shaped mound. These colonies may persist for many years and, as they mature, contain a population running into millions. All attacks by subterranean termites originate from the nest but timber either lying on or buried in the ground may be reached by means of shelter tubes constructed within, or over such materials or else by the erection of an independent, free standing mud structure. Chemical barriers which prevent the termites from reaching the super-structure of the building will protect the building and its contents. Treating the soil beneath the building and around the foundations with a soil insecticide is a good preventing measure. The purpose of this treatment is to create a chemical barrier between the ground from where the termites come and the woodwork, cellulosic materials and other contents of the buildings which may form food for the termites. Timber which is seasoned and is naturally durable in heartwood or such species of timber which can be adequately treated to the desired retention of preservative for durability, may be used in the building structure. However, non-durable timbers and sapwood of all timbers should be treated for durability to withstand the attack of dry wood termites [*see* IS 401 : 2001 'Preservation of timber — Code of practice (*fourth revision*)' and IS 1141 :1993 'Seasoning of timber — Code of practice (*second revision*)'].

This standard (Part 2) was first published in 1971 and subsequently revised in 1981, 2001 and 2013.

This Indian Standard is published in three parts. The other parts in this series are:

Part 1 Constructional measures

Part 3 Treatment for existing buildings

In the 2013 revision, the chemical lindane was removed and imidacloprid was introduced; use of watering cans for chemical disposal was dispensed with; and treatment to simple RCC basement buildings was included, apart from some other modifications.

In view of the developments since the last revision and based on the further knowledge that has become available, the committee responsible for formulation of this standard decided to take up its revision.

In this fourth revision, the following significant modifications have been incorporated:

a) Bifenthrin has been added to the existing chemicals namely chlorpyrifos and imidacloprid recommending its use for anti-termite treatment.

b) An informative annex on typical calculation of amount of chemical solution required for treatment for foundations, including masonry, RCC, pile and raft foundations has been included as Annex C.

(*Continued on third cover*)

Indian Standard

ANTI-TERMITE MEASURES IN BUILDINGS — CODE OF PRACTICE

PART 2 PRE-CONSTRUCTIONAL CHEMICAL TREATMENT MEASURES

(Fourth Revision)

1 SCOPE

This standard (Part 2) covers practices for chemical treatment of soils for the protection of buildings from attack by subterranean termites. It includes reference to chemicals to be used, lays down minimum rates of application for usage, and outlines procedure to be followed while the building is under construction.

2 REFERENCES

The Indian Standards listed below contain provisions, which through reference in this text, consitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below:

IS No.	*Title*
456 : 2000	Plain and reinforced concrete — Code of practice (*fourth revision*)
4015 : 1998	Guide for handling cases of pesticide poisoning (*first revision*)
8944 : 2005	Chlorpyrifos, emulsifiable concentrates — Specification (*first revision*)
15936 : 2011	Pesticide — Bifenthrin, technical — Specification
16131 : 2015	Imidacloprid suspension concentrate (SC) — Specification

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Chemical Barrier — The layer of chemically treated soil in immediate contact with the foundation and floor structure or basement of a building which kills or repels termites thus forming a barrier which is impervious to termite entry.

3.2 Soil Treatment — The application of chemicals (toxicant solutions) to the soil adjacent to and under a building to form a chemical barrier which is lethal or repellent to termites.

3.3 Pre-Construction Soil Treatment — The process in which soil chemical treatment is applied to a building during the early stage of its construction.

4 SITE PREPARATION

4.1 The removal of trees, stumps, logs or roots from a building site reduces the hazards from subterranean termites. Similary, the subfloor area should be kept free from all debris in which new colonies of termites might be established. In order to ensure uniform distribution of the treating solution and to assist penetration, some site preparation, may be necessary. The information given **4.1.1** to **4.1.4** is for guidance in preparing a building site for chemical treatment.

4.1.1 *Heavy Soils and Sloping Sites*

On clay and other heavy soils where penetration is likely to be slow, and on sloping site where run off of the treating solution is likely to occur, the surface of the soil should be scarified to a depth of at least of 75 mm.

4.1.2 *Sandy or Porous Soils*

On loose, sandy or porous soils where loss of treating solution through piping or excessive percolation is likely to occur, preliminary moistening to fill the capillary spaces in the soil is recommended.

4.1.3 *Levelling, Excavations and Filling*

All subfloor levelling and grading should be completed; all cuttings, trenches and excavations should be completed with backfilling in place, borrowed fill should be free from organic debris and should be well compacted. If this is not done, supplementary treatment should be made to complete the barrier.

4.1.4 *Removal of Concrete Formwork and Other Materials*

All concrete formwork, levelling pegs, timber off-cuts and other builder's debris should be removed from the area to be treated.

5 CHEMICALS AND RATE OF APPLICATION

5.1 Basic Principle

Chemicals toxic to subterranean termites may be used effectively to check termite infestation in the soil. These are useful in the treatment of new building sites and may also be used to eradicate existing infestation in buildings and to prevent reinfestation. The effectiveness and/or residual activity depend upon the choice of the chemicals, the dosages adopted and the thoroughness of application. The chemical solutions or emulsions are required to be dispersed uniformly in the soil and of the required strength so as to form an effective chemical barrier which is lethal and repellent to termites.

5.2 Mound Treatment

If termite mounds are found within the plinth area of the buildings, these should be destroyed by means of insecticides in the form of water suspension or emulsion which should be poured into the mounds at several places (within the mound) after breaking open the earthen structure and making holes with crowbars. The quantity to be used will depend upon the size of mound. For a mound volume of about 1 m^3, 4 litres of water based chemical shall be used.

5.3 Chemical Solution

5.3.1 *Chemicals to be Used for Soil Treatment*

Treating the soil beneath the building and around the foundations with a soil insecticide is a preventive measure. The purpose of the treatment is to create a continuous chemical barrier between the ground from where termites come and woodwork or other cellulosic materials in the buildings.

The chemicals given in Table 1 conforming to relevant available Indian Standards, in water emulsion are effective when applied uniformly over the area to be treated.

Necessary precautions as in the Material Safety Data Sheets (MSDS) supplied by manufacturers shall be ensured including when applying the termiticides in the exterior of a building where pisciculture/aquaculture is practiced, near water bodies and during foraging period of honey bees as some termiticides are toxic to honeybees and fishes.

5.3.2 *Water to be Used for Preparing Chemical Solution*

Quality of water used to prepare chemical solution shall conform to IS 456. Potable water from municipal supply is considered suitable for the purpose.

Table 1 Chemicals for Anti-termite Treatment

(*Clause* 5.3.1)

Sl No.	Chemical	Relevant Indian Standard	Concentration by Mass, Percent (Active Ingredient)	Dosage
(1)	(2)	(3)	(4)	(5)
i)	Chlorpyrifos 20 percent Emulsifiable Concentrate (EC)	IS 8944	1.0	250 ml in 5 litre water 50 ml in 1 litre water
ii)	Imidacloprid 30.50 percent Suspension Concentrate (SC)	IS 16131	0.075	10.5 ml in 5 litre water 2.1 ml in 1 litre water
iii)	Bifenthrin 2.5 percent Emulsifiable Concentrate (EC)	*See* Note 3	0.05	100 ml in 5 litre water 20 ml in 1 litre water

NOTES

1 The above mentioned chemicals are registerd (as on date) chemicals with the Central Insecticides Board – Registration Committee (CIB RC). Efforts will be made to update (add/delete) the list of chemicals (termiticides) as obtained time to time from the CIB RC for incorporation in the above table appropriately. However, the chemicals from the above table as available in the CIB RC's approved list at any point of time, shall only be used.

2 The chemicals described in this standard are insecticides with a persistent action and are regarded highly poisonous. These chemical can have an adverse effect upon health when absorbed through the skin, inhaled as vapours or spray mist or swallowed. Detailed precautions for the safe handling of these chemicals are given in Annex A. Persons carrying out chemical soil treatment in accordance with this standard should familiarize themselves for these precautions and exercise due care when handling the chemical whether in concentrate or in diluted form. The use of the chemical should be avoided where there is any risk of wells or other water supplies becoming contaminated.

3 IS 15936 provides specification for bifenthrin - technical for pesticide purposes, which needs to be suitably referred until a separate Indian Standard on emulsifiable concentrate of bifenthrin is formulated.

6 REQUIREMENTS FOR BARRIER AND METHOD OF APPLICATION

6.1 Conditions of Formation

Barrier shall be complete and continuous under the whole of the structure to be protected. All foundations shall be fully surrounded by and in close contact with the barrier or treated soil. Each part of the treated area shall receive the prescribed dosage of chemical.

6.2 Time of Application

Soil treatment should start when foundation trenches and pits [in case of load bearing structure and basements (with no backfills inside the basement walls)] are ready to take mass concrete in foundations. Laying of mass concrete should start when the chemial emulsion has been absorbed by the soil and the surface is quite dry. Treatment should not be carried out when it is raining or when the soil is wet with rain or subsoil water. The foregoing requirements applies also in the case of treatment to the filled earth surface within the plinth area before laying the subgrade for the floor.

6.3 Disturbance

Once formed, treated soil barriers shall not be disturbed. If, by chance, treated soil barriers are disturbed, immediate step shall be taken to restore the continuity and completeness of the barrier system.

7 TREATMENT

7.1 Soil Treatment

7.1.1 The chemical solution described in **5.3** shall be applied uniformly at the prescribed rate in all the stages of the treatment. Hand operated pressure pump with sprayer or an electrically operated pump with sprayer shall be used for uniform spraying of the chemical solution from graduated containers. Alternatively watering can with sprayer may also be used depending upon site specific constraints. Proper check shall be kept so that the specified quantity of chemical is used for the required area during the operation.

7.1.2 In the event of waterlogging of foundation, the water shall be pumped out and the chemicals should be applied when the soil is absorbent .

7.2 Treatment for Masonry Foundations and Basements (Load Bearing Structures)

7.2.1 *Treatment to Trenches Made for Foundation of Masonry Walls or Basement*

The bottom surface and the sides (upto a height of about 300 mm) of the excavations made for masonry foundations and basements shall be treated with the chemical at the rate of 5 l/m^2 surface area (*see* Fig. 1).

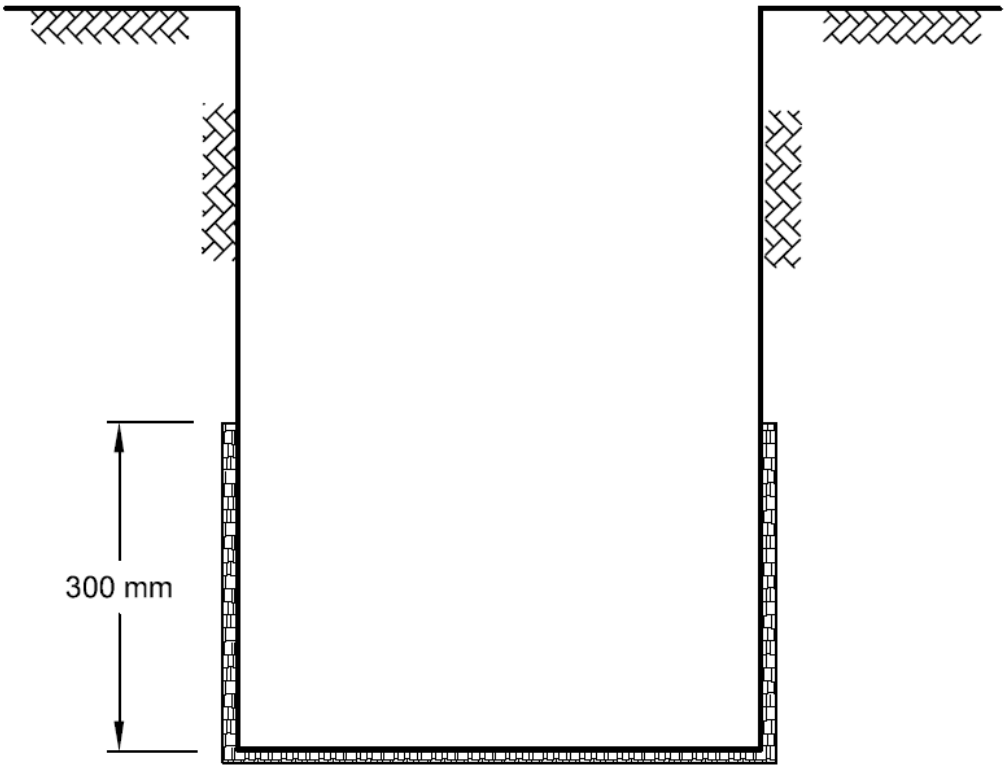


FIG. 1 TREATMENT OF TRENCH BOTTOM AND SIDES

7.2.2 *Treatment to Vertical Backfilled Soil Along Masonry Foundation/Retaining Wall*

After the masonry foundations and the retaining wall of the basements come up, the backfill in immediate contact with the foundation structure shall be treated at the rate of 7.5 l/m^2 of the vertical surface of the sub-structure for each side. If water is used for ramming the earth fill, the chemical treatment shall be carried out after the ramming operation is done by rodding the earth at 150 mm centres close to parallel to the wall surface and spraying the chemical at the above mention dosage. After the treatment, the soil should be tamped in place. If the filled earth has been well rammed and the surface does not allow the emulsion to seep through, holes upto 50 mm to 75 mm deep at 150 mm centres both ways may be made with 12 mm diameter mild steel rod on the surface to facilitate saturation of the soil with the chemical.

The earth is usually returned in layers and the treatment shall be carried out in similar stages. The chemical shall be directed towards the masonry surfaces so that the earth in contact with these surfaces is well treated with the chemical (*see* Fig. 2 and Fig. 3).

7.2.3 *Treatment of Top Surface of Plinth Filling*

The top surface of the consolidated earth within plinth walls shall be treated with chemical at the rate of 5 l/m^2 of the surface before the sand bed or sub-grade is laid. This treatment shall also be carried out on DPC provided on plinth wall. If the filled earth has been well rammed and the surface does not allow the emulsion to seep through, holes up to 50 mm to 75 mm deep at 150 mm centres both ways may be made with 12 mm dimeter mild steel rod on the surface to facilitate saturation of the soil with the chemical.

7.2.4 *Treatment at Junction of Wall and Floor*

Special care shall be taken to establish continuity of the vertical chemical barrier on inner wall surface from ground level (where it had stopped with the treatment described in **7.2.2**) up to level of the filled earth surface. To achieve this, a small channel 30 mm × 30 mm shall be made at all the junction of wall and columns with the floor (before laying the subgrade) and the rod holes made within the channel up to the ground level 150 mm apart and the iron rod moved backward and forward to break up the earth and chemical poured along the wall at the rate of 7.5 l/m^2 of vertical wall or column surface so as to soak the soil right to the bottom. The soil should be tamped back into place after the operation.

NOTE — The above procedure generally addresses those cases where the depth of plinth is less than 1 m. However, in cases where the depth of plinth is beyond 1 m, to enable the chemicals reach such depths, the total height shall have to be considered for the calculation of chemical volume while using the rate of chemical (7.5 l/m^2). Also, in such cases care should be taken so that the chemicals slowly percolate down along the wall surface. This would ensure an uninterrupted chemical barrier vertically at the junctions of wall and floor from the last treatment described in **7.2.2**.

7.2.5 *Treatment of Soil Along External Perimeter of Building*

7.2.5.1 After the building is complete, the earth along the external perimeter of the builiding should be rodded at intervals of 150 mm and to a depth of 300 mm. The rods should be moved backward and forward parallel to the wall to break up the earth and chemical poured along the wall at the rate of 7.5 l/m^2 of the vertical surface. After the treatment, the earth should be tamped back into place. Should the earth outside the building be graded on completion of building, this treatment shall be carried out on completion of such grading. Such holes shall be made as near as possible to the wall, column and footing but without damaging them so that required protection is achieved.

7.2.5.2 In the event of filling being more than 300 mm, the external perimeter treatment shall extend to the full depth of filling up to the ground level so as to ensure continuity of the chemical barrier.

7.2.6 *Treatment of the Soil Below Apron*

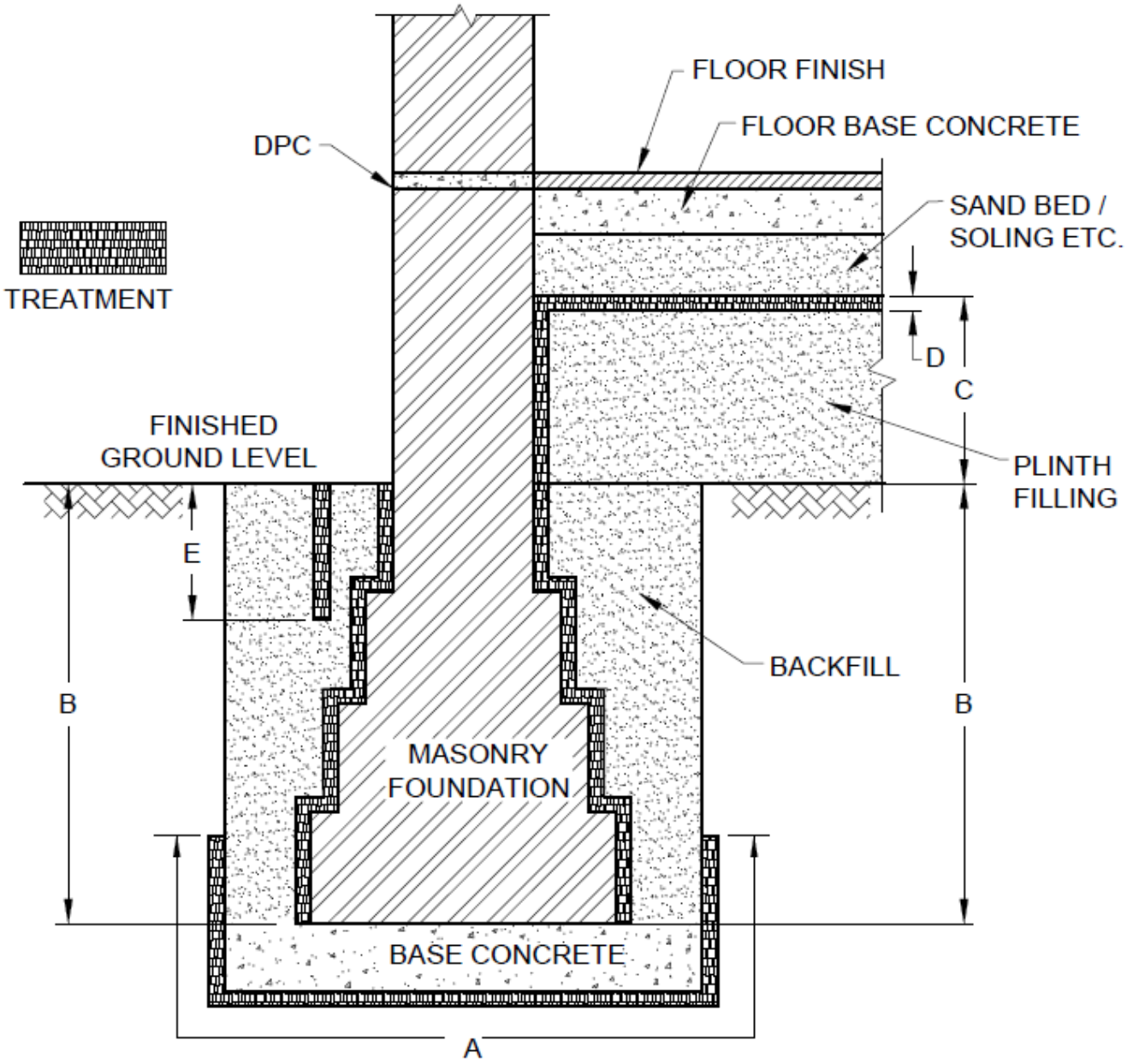
After construction of a new building, and where there is a provision of apron around building, separate treatment is recommended for the soil below such apron. This treatment shall be carried out similar to the treatment mentioned in **7.2.3**, that is, treatment for top surface of plinth filling. Wherever aprons are provided around a building, treatment below the apron is required for a distance maximum 1 m of the apron from face of the building even if the apron extends more from face of the building.

7.3 Treatment for RCC Foundations (Buildings without Basements)

7.3.1 In the case of reinforced cement concrete (RCC) foundations, the treatment shall start at a depth of 500 mm below the ground level except when such ground level is raised or lowered by filling or cutting after the foundations have been cast. In such cases, the depth of 500 mm shall be determined from the new soil level resulting from the filling or cutting mentioned above, and soil in immediate contact with the vertical surfaces of RCC. Foundations shall be treated at the rate of 7.5 l/m^2 (*see* Fig. 4).

7.3.2 *Treatment of Top Surface of Plinth Filling*

The top surface of the consolidated earth within plinth walls shall be treated with chemical at the rate of 5 l/m^2 of the surface before the sand bed or subgrade is laid. If the filled earth has been well rammed and the surface does not allow the emulsion to seep through, holes up to 50 mm to 75 mm deep at 150 mm centres both ways may be made with 12 mm dimeter mild steel rod on the surface to faciliatate saturation of the soil with the chemical.



Stages of Treatment:

A — bottom and sides of trenches (*see* **7.2.1**)

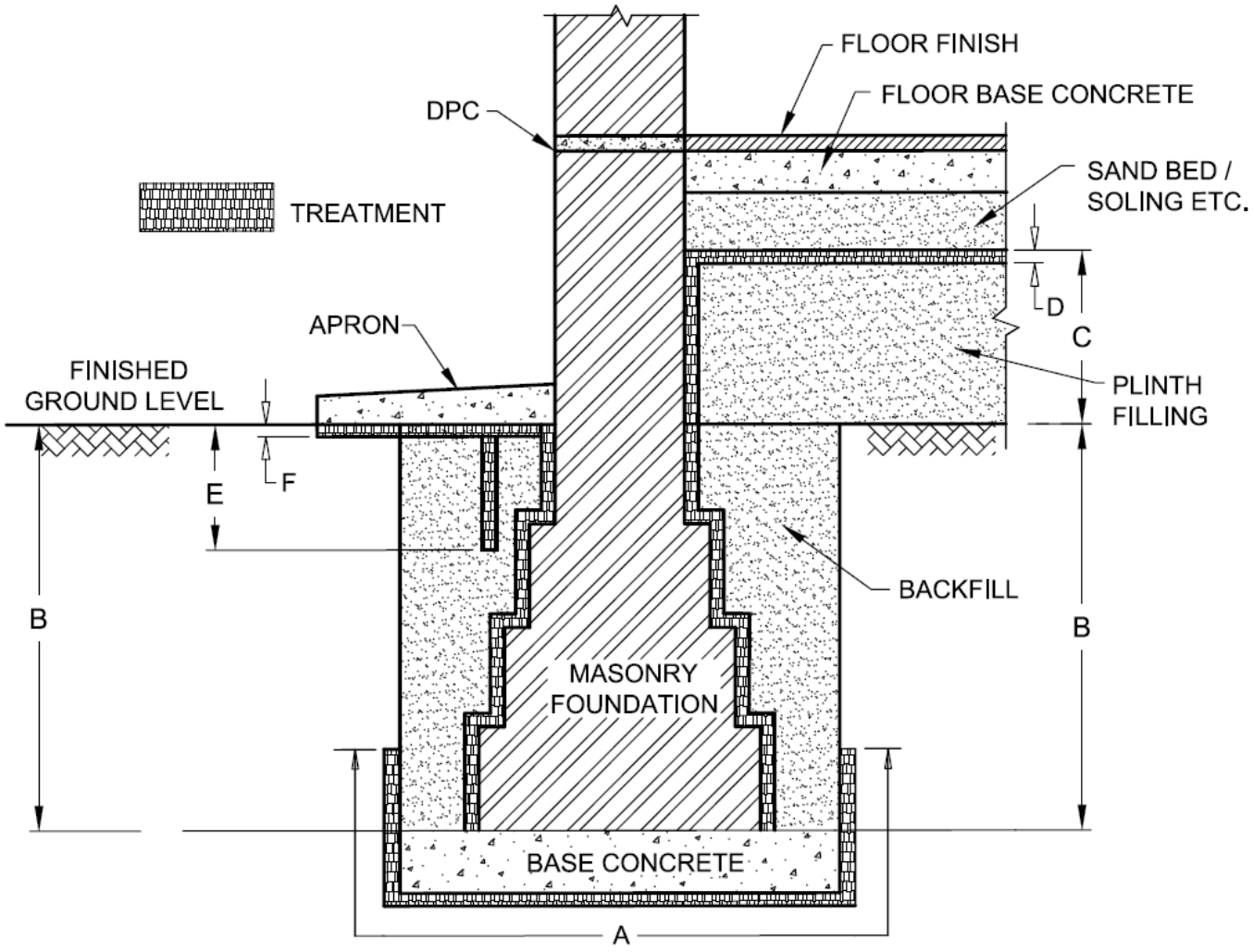
B — backfill in immediate contact with foundation walls (*see* **7.2.2**)

C — junction of wall and floor (*see* **7.2.4**)

D — top surface of plinth filling (*see* **7.2.3**)

E — external perimeter of building (*see* **7.2.5**)

FIG. 2 TREATMENT FOR MASONRY FOUNDATIONS WITHOUT APRON



Stages of Treatment:

A — bottom and sides of trenches (*see* **7.2.1**)

B — backfill in immediate contact with foundation walls (*see* **7.2.2**)

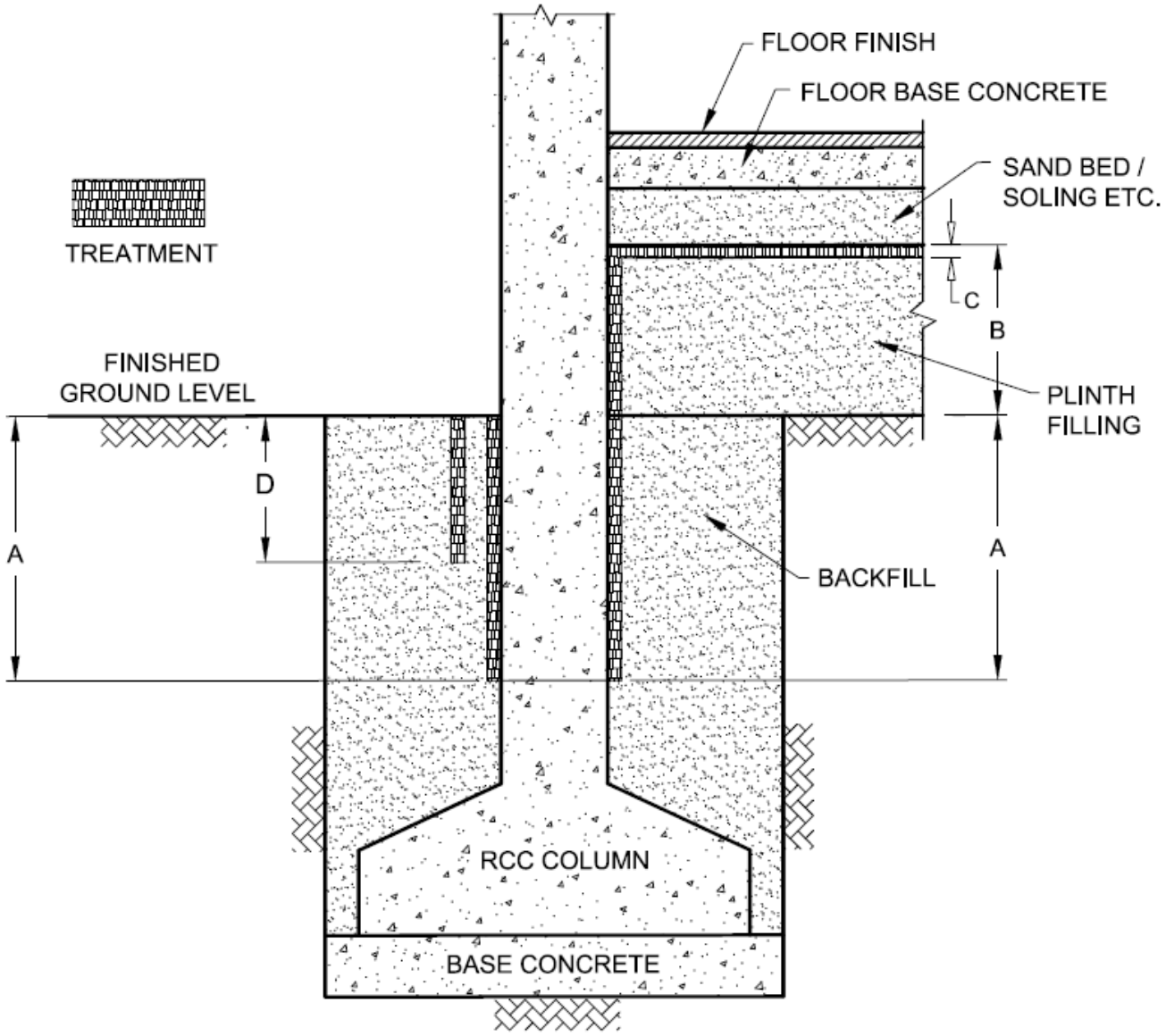
C — junction of wall and floor (*see* **7.2.4**)

D — top surface of plinth filling (*see* **7.2.3**)

E — external perimeter of building (*see* **7.2.5**)

F — soil below apron (*see* **7.2.6**)

FIG. 3 TREATMENT FOR MASONRY FOUNDATIONS WITH APRON ALONG EXTERNAL PERIMETER



Stages of Treatment:

A — backfill in immediate contact with foundation walls (*see* **7.2.2**)

B — junction of wall and floor (*see* **7.3.3**)

C — top surface of plinth filling (*see* **7.3.2**)

D — external perimeter of building (*see* **7.3.4**)

FIG. 4 TREATMENT FOR RCC FOUNDATIONS

7.3.3 *Treatment at Junction of Wall and Floor*

Special care shall be taken to establish continuity of the vertical chemical barrier on inner wall surface from ground level (where it had stopped with the treatment described in **7.3.1**) up to level of the filled earth surface. To achieve this, a small channel 30 mm × 30 mm shall be made at all the junction of wall and columns with the floor (before laying the sub-grade) and the rod holes made within the channel up to the ground level 150 mm apart and the iron rod moved backward and forward to break up the earth and chemical poured along the wall at the rate of 7.5 l/m^2 of vertical wall or column surface so as to soak the soil right to the bottom. The soil should be tamped back into place after the operation.

7.3.4 *Treatment of Soil Along External Perimeter of Building*

After the building is complete, the earth along the external perimeter of the buiilding should be rodded at intervals of 150 mm and to a depth of 300 mm. The rods should be moved backward and forward parallel to the wall to break up the earth and chemical poured along the wall at the rate of 7.5 l/m^2 of the vertical surface. After the treatment, the earth should be tamped back into place. Should the earth outside the building be graded on completion of building, this treatment shall be carried out on completion of such grading. Such holes shall be made as near as possible to the wall, column and footing but without damaging them so that required protection is achieved.

7.3.4.1 In the event of filling being more than 300 mm, the external perimeter treatment shall extend to the full depth of filling up to the ground level so as to ensure continuity of the chemical barrier.

NOTE — Wherever, making manual holes beyond 300 mm and up to say 500 mm is not possible due to prevailing site conditions, in order to penetrate the total expected chemical, the entire depth shall have to be considered so as to evaluate the probable total consumption required and slow penetration of the same be ensured which would create the barrier upto the prescribed depth.

7.3.5 *Treatment of Soil Surrounding Pipes, Wastes and Conduits*

When pipes, wastes and conduits enter the soil inside area of the foundations, soil surrounding the point of entry shall be loosened around each such pipe, waste or conduit for a distance of 150 mm and to a depth of 75 mm before treatment is commenced. When they enter the soil external to the foundation, they shall be similarly treated at a distance of over 300 mm unless they stand clear of the walls of the building by about 75 mm.

7.3.6 *Treatment for Expansion Joints*

Expansion joints at ground floor level are one of the biggest hazards for termite infestation. The soil beneath these joints should receive special attention when the treatment under **7.3.2** is carried out. This treatment should be supplemented by treating through the expansion joints after sub-grade has been laid, at the rate of 2 litre per linear metre.

7.4 Treatment to RCC Basement Buildings

The treatment starts after the excavation for basement is complete and before laying soling and Plain Cement Concrete (PCC). The treatment shall be carried out in the following stages (*see* Fig. 5).

7.4.1 *Treatment to Soil Below Raft*

Before laying the rubble soling and PCC, the compacted and levelled soil shall be treated at 5 l/m^2.

NOTE — In case of soils/sand filled above the raft, the treatment at 5 l/m^2 shall be carried out on the top surface of filled soil/sand. In such case, treatment to soil/sand below raft may not be necessary.

7.4.2 *Treatment to Soil Along the Retaining Wall*

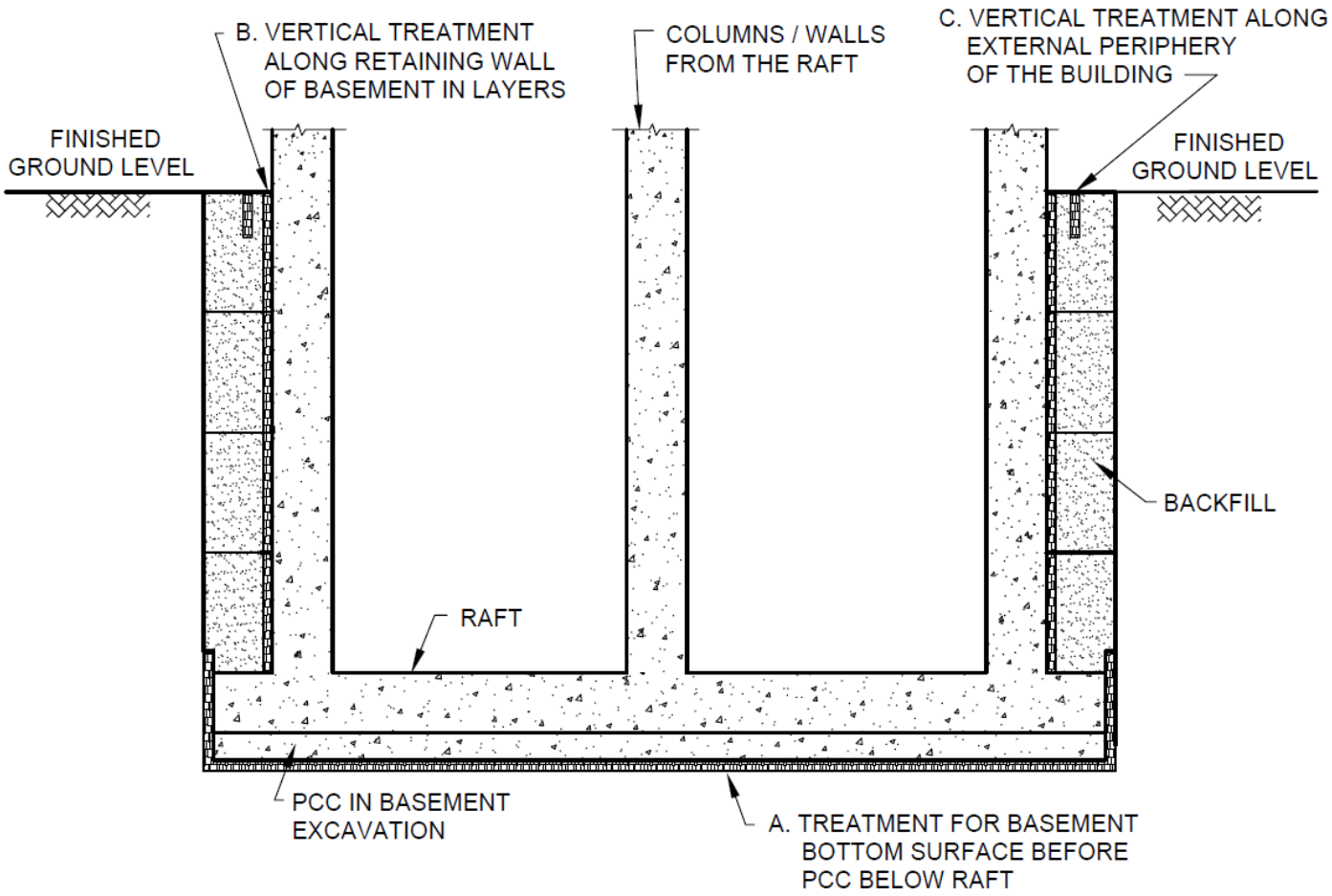
The soil retained by the walls (soil coming in contact with retaining wall) shall be treated at the rate of 7.5 l/m^2 of the vertical surface so as to effect a continuous outer chemical barrier, in continuation with that of the one formed under **7.4.1**. The treatment shall follow the backfilling in stages of 300 mm. However rodding may be carried out to facilitate the treatment.

7.4.3 *Treatment of Soil Along External Perimeter of Building*

After the building is complete, the earth along the external perimeter of the buiilding should be rodded at intervals of 150 mm and to a depth of 300 mm. The rods should be moved backward and forward parallel to the wall to break up the earth and chemical poured along the wall at the rate of 7.5 l/m^2 of the vertical surface. After the treatment, the earth should be tamped back into place. Should the earth outside the building be graded on completion of building, this treatment shall be carried out on completion of such grading. Such holes shall be made as near as possible to the wall, column and footing but without damaging them so that required protection is achieved.

7.4.4 *Treatment of Soil Surrounding Pipes, Wastes and Conduits*

When pipes, wastes and conduits enter the soil, the inside area of the foundations, soil surrounding the point of entry shall be loosened around each such pipe, waste or conduit for a distance of 150 mm and to a depth of 75 mm before treatment is commenced. When they enter the soil external to the foundation, they shall be similarly treated at a distance of over 300 mm unless they stand clear of the walls of the building by about 75 mm.



Stages of Treatment:

A — below raft (*see* **7.4.1**)

B — along the retaining wall (*see* **7.4.2**)

C — external perimeter of building (*see* **7.4.3**)

FIG. 5 TREATMENT FOR RCC BASEMENT BUILDING- STAGES OF TREATMENT

7.4.5 Typical details of treatment to the RCC basement buildings with backfill within the basement walls above the raft, is given in Fig. 6. In this case, it may not be necessary to treat the excavated areas below the foundation/PCC/raft.

NOTES

1 In the case of backfill of soil around columns/footings within the basement but above raft, the treatment shall start at a depth of 500 mm below the compacted filled soil or new soil level and soil in immediate contact with the vertical surfaces of RCC. Foundations shall be treated at the rate of 7.5 l/m^2.

2 After creating a vertical chemical barrier around the columns/ footings, the entire horizontal surface of the compacted filled soil within the plinth before the soling/flooring/PCC/tremix shall be treated with the solution at the rate of 5 l/m^2.

7.4.6 Typical details of treatment to RCC basement buildings with pile foundation is given for deeper basements in Fig. 7 and for shallower basements in Fig. 8; in which it is not necessary to treat the excavated areas below the foundation/PCC/raft.

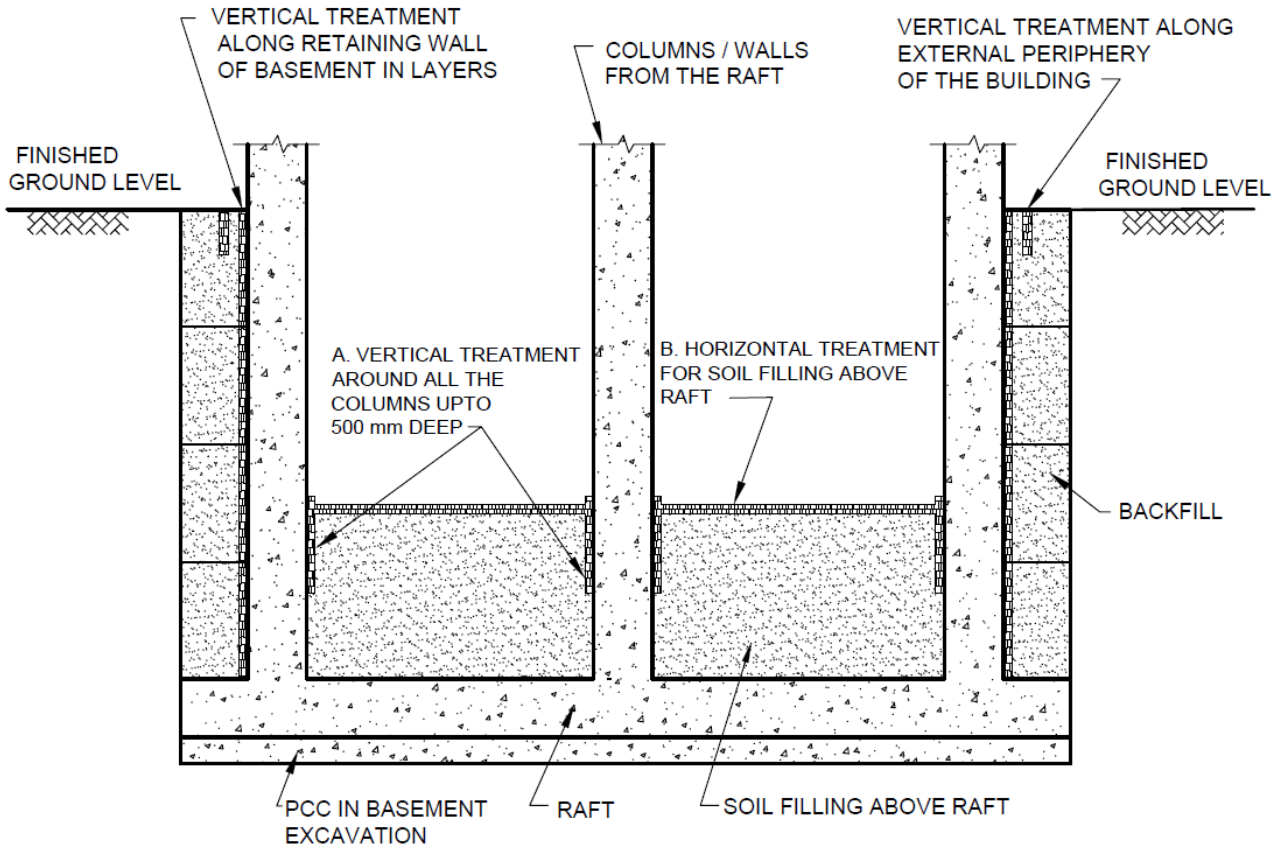


FIG. 6 TREATMENT FOR BASEMENT WHEN THERE IS FILLING ABOVE RAFT

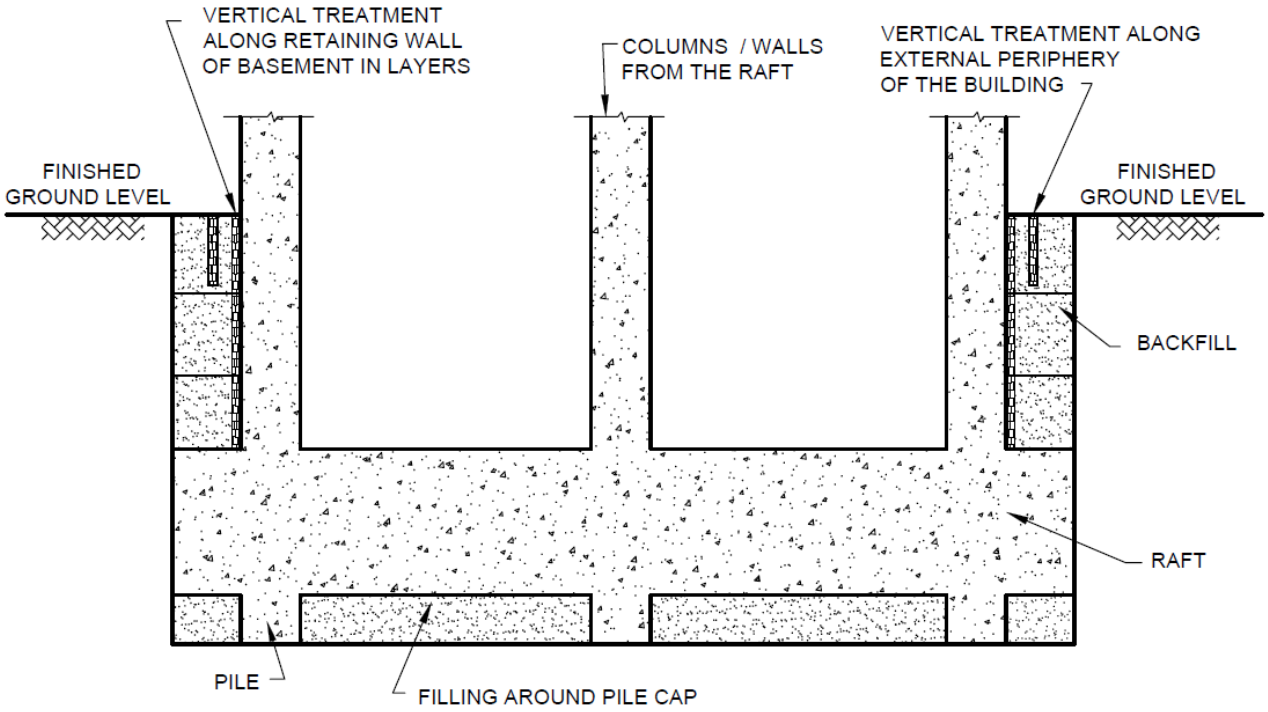


FIG. 7 TREATMENT FOR DEEP BASEMENT WITH PILE FOUNDATION

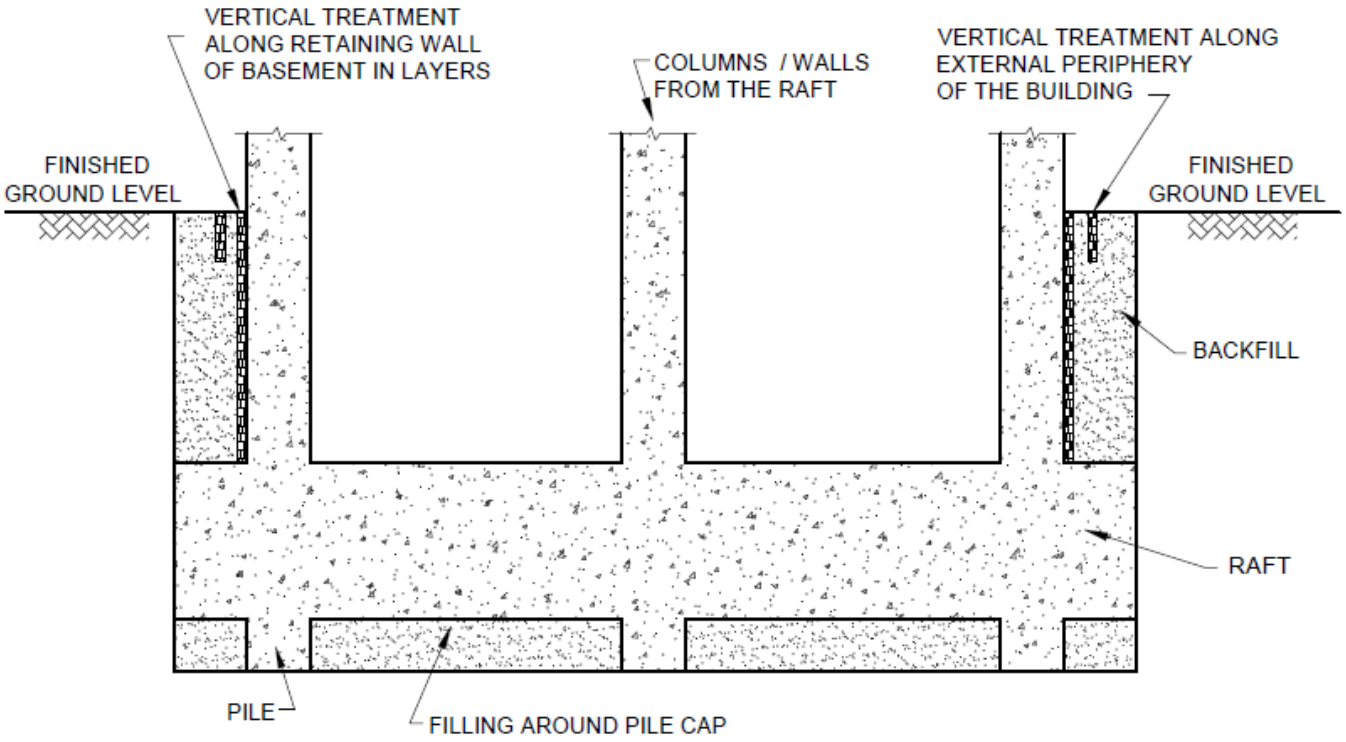


FIG. 8 TREATMENT FOR SHALLOW BASEMENT WITH PILE FOUNDATION

ANNEX A

(*Table* 1)

SAFETY PRECAUTIONS

A-1 PRECAUTIONS FOR HEALTH HAZARDS AND SAFETY MEASURES

A-1.1 All the chemicals mentioned in **5.3.1** are poisonous and hazardous to health. These chemical can have an adverse effect upon health when absorbed through the skin, inhaled as vapours or spray mist or swallowed. Persons handling or using these chemical should be warned of these dangers and advised that absoroption through the skin is the most likly sources of accidental poisoning. They should be cautioned to observe carefully the safety precautions given in **A-1.2** to **A-1.6** particularly when handling these chemicals in the form of concentrates.

A-1.2 These chemicals are brought to the site in the form of emulsifiable concentrate/suspension concentrate. The container should be clearly labelled and should be stored carefully so that children and pets cannot get at them. They should be kept securely closed.

A-1.3 Particular care should be taken to prevent skin contact with concentrates. Prolonged exposure to dilute emulsions should also be avoided. Workers should wear clean clothing and should wash thoroughly with soap and water specially before eating and smoking. In the event of severe contamination, clothing should be removed at once and the skin washed with soap and water. If chemicals splash into the eyes they shall be flushed with plenty of soap and water and immediate medical attention should be sought.

A-1.4 The concentrates are oil solutions and present a fire hazard owing to the use of petroleum solvents. Flames should not be allowed during mixing.

A-1.5 Care should be taken in the application of soil toxicants to see that they are not allowed to contaminate wells or springs which serve as sources of drinking water.

A-1.6 The person/operator who uses the chemicals shall wear Personal Protective Equipments (PPE), like hand gloves, eye goggles, face masks, safety shoes, ear muffler and cap.

A-1.7 In case of poisoning, suitable measures shall be taken for protection in accordance with IS 4015.

A-1.8 The application of anti-termite treatment should be carried out by a professional agency which is trained and possess a valid licence issued by the respective state/central government department of agriculture as required under the *Insecticides Act,* 1968 and the Rules framed thereunder.

ANNEX B

(*Informative*)

(*Foreword*)

A SHORT NOTE ON TERMITES

B-1 CLASSIFICATION

B-1.1 Termites constitute a separate order of insects called ‘Isoptera’ (*isos* is ‘equal ‘ and *pteron* means ‘wing’ in Greek). Although, they are commonly called white ants, they are not related to ants who have a thin waist in contrast to the thick waist of the termites. Furthermore, the front pair of wings of the ants are longer than their hindpair whereas in termites, both pairs are equal. There are over 2 300 species of termites out of which about 220 are found in India. All these species are not considered to be serious pests.

B-1.2 According to their habitats, termites can be divided into two well defined groups:

a) subterranean termites which build nests and live in the soil, and

b) non-subterranean termites which live in wood and do not require contact with the soil.

B-1.3 Subterranean termites require moisture to sustain their life. They need access to ground at all times. They build tunnels between their nest and source of food through earth and earth-like covered runways around obstructions. These covered tunnels provide humidity conditions and darkness necessary for their movement and for maintaining contact with earth. The subterranean termites enter a building from ground level, under the foundation, working their way upwards through floors, destroying all before them. So little is

seen of these termite operations that sometimes the structural member attacked is found to be merely a shell with the inside completely riddled and eaten away.

B-1.4 The drywood termites on the contrary are able to live even in fairly dry wood and without contact with ground. These frequently construct nests within the roofs and other parts of houses, which they destroy, if not speedily exterminated. However, they are not as prevalent and common as subterranean termites, and are generally confined to coastal regions.

B-1.5 A subterranean termite colony consists of a pair of reproductives, the so-called king and queen and a large number of sterile workers and soldiers. If however, the queen is lost or destroyed, her place is taken by number of supplementary reproductives, thus even by removing the queen, the colony will not be destroyed. All the work of the colony is carried out by the workers. Guarding the colony is the work of the soldiers. The adult workers and soldiers are wingless. The workers are gernerally greyish white in colour. The soldiers are generally darker than the workers and have a large head and longer mandibles. There are, however, other types of soldiers whose mandibles are small, degenerated and functionless; instead, the frontal part of the head is prolonged to form a long nasus; they dispel the enemy by squirting out of white poisonous fluid through the nasus. The reprodutives, that is, the flying adults, have brown or black bodies and are provided with two pairs of long wings of equal size in contrast to the reproductives of ants which have two pairs of wings of unequal size.

B-1.6 The food of the termite is cellulosic material like timber, grass, stumps of dead trees, droppings of herbivorous animals, paper, etc. Once termites have found a suitable foothold in or near a building, they start spreading slowly from a central nest through underground and overground galleries in the case of subterranean termites and galleries within the structural member, once they get direct access to them, in the case of drywood termites. In their search for wood they bypass any obstacle like concrete or resistant timber to get a suitable food many meters away.

B-1.7 In subterranean termite colony, the workers feed the reproductives, soldiers, winged adults and young nymphs. One of the habits of the termites which is of interest is the grooming of their own bodies and the bodies of their nest mates by licking. This grooming habit is associated with their eagerness to obtain the glandular secretions that are extruded over the body surface. During the course of grooming, any dust particle that may be adhering to the body surface are removed and ingested. This habit plays an important role in the poisoning of termites for control operations. If finely powdered toxic material is introduced into termite runways, particles of the powder will adhere to the body of the termite and will kill any termite that subsequently grooms the dusted one.

B-2 DEVELOPMENT OF TERMITE COLONY

At certain periods of the year, particularly after a few warm days followed by rain, emergence of winged adults or colonising flights, frequently occurs. This swarming, also called the nuptial flight, may take place any time during the monsoon or the post monsoon period. The flight is short and most of the adults perish due to one reason or another. The surviving termites soon find their mates, shed their wings and establish a colony if circumstances are favourable. The female of the pair or queen produces a few eggs in the first year. The first batch of the brood comprises only of workers. The rate of reproduction, however, increases rapidly after 2-3 years. Although a colony may increase in size comparatively rapidly very little damage may occur in a period less than 8-10 years. Any serious damage that may occur in a short time is perhaps due to heavy infestation in the initial stage due to large population of termites existing in the soil before the building is constructed.

B-3 RECOGNIZING THE PRESENCE OF TERMITE INFESTATION IN BUILDINGS

B-3.1 Swarms of winged reproductives flying from the soil or wood are the first indication of termite infestation in a building. Often the actual flight may not be observed but the persence of wings discarded by them will be a positive indication of a well established termite colony nearby. Termite damage is not evident from the exterior in the case of subterranean termites, since they do not reduce wood to a powdery mass or push particles like some of the wood borers or drywood termites. These termites are also recognised by the presence of earth-like shelter tubes which afford them the runways between soil and their food.

B-3.2 Drywood termites on the contrary may be recognised by their pellets of excreta. Non-subterranean termites excrete pellets of partly digested wood. These may be found in tunnels or on the floor underneath the member which they have attacked. These termites may further be noticed by blisters on wood surfaces due to their forming chambers close to the surface by eating away the wood and leaving only a thin film of wood on the surface. Also the hollow sound on tapping structural timber will indicate their destructive activity inside.

ANNEX C

(*Informative*)

(*Foreword*)

TYPICAL CALCULATION OF AMOUNT OF CHEMICAL SOLUTION REQUIRED FOR TREATMENT OF DIFFERENT FOUNDATIONS

C-1 MASONRY FOUNDATION

C-1.1 Calculation for a Building of Size 50 m × 20 m at Plinth Level

a) Area of plinth is 50 m × 20 m, that is, 1 000 m^2;

b) Approximately 20 percent of the plinth area is covered by the excavation for masonry foundation that is, 200 m^2;

c) Total peripheral length of external walls will be 140 m; and

d) To calculate the area of junctions of wall and floor, the total depth of plinth needs to be considered. Here, the depth of plinth is assumed as 1.5 m.

NOTE — Sample calculations given in this annex are informative in nature. While calculating required total consumption of the chemical for any site, actual area as per the recommendations given in this standard shall be taken.

C-1.2 The dosage/concentration ratio of respective termiticides are as follows:

a) Chlorpyrifos 20 percent EC — 50 ml chemical per 1 litre of water

b) Imidachloprid 30.5 percent SC — 2.1 ml chemical per 1 litre of water

c) Bifenthrin 2.5 percent EC — 20 ml chemical per 1 litre of water

C-1.3 The consumption of solution (chemical diluted with water) as well as the concentrated termiticides (recommended) will be as under:

C-1.3.1 *First Treatment – Bottom and Sides of Trenches*

For bottom surface of trench - For 50 m × 20 m of plinth size, 20 percent of the total plinth is covered by excavation that is, 200 m^2 × 5 litres per m^2 = 1 000 litre total consumption of solution.

For sides of trench- average peripheral length of trench (that is, 140 m) × 0.3 m × 2 (for both sides) × 5 litres per m^2 = 420 litre total consumption of solution.

C-1.3.2 *Second Treatment – Backfill in Immediate Contact with Foundation Walls*

Average peripheral length of masonry foundation (that is, 140 m) × 0.5 m approximately (take actual depth of treatment area of backfill in immediate contact with foundation wall) × 7.5 litres per m^2 × 2 (for both sides) = 1 050 litres total consumption of solution.

C-1.3.3 *Third Treatment – Junction of Wall and Floor*

For building area 50 m × 20 m , average peripheral length that is, 140 running metre × 1.5 m approximately (depth of walls below the plinth level is considered on average) × 7.5 litres per m^2 = 1 575 litres total consumption of solution.

C-1.3.4 *Fourth Treatment – Top Surface of Plinth Filling*

Total area of plinth (that is, 1 000 m^2) 5 litres per m^2 = 5 000 litres total consumption of solution.

C-1.3.5 *Fifth Treatment – External Periphery*

For 50 m × 20 m plinth area, average peripheral length, that is, total 140 running metre, 140 × 0.3 (depth) × 7.5 litres per m^2 = 315 litres.

NOTE — Where there is a provision of apron around building, separate treatment is recommended for the soil below such apron and accordingly total consumption of solution for this treatment shall also be calculated.

C-1.4 In line with the calculations in **C-1.3**, a summary of calculations with different chemicals is given below:

	First Treatment	***Second Treatment***	***Third Treatment***	***Fourth Treatment***	***Fifth Treatment***	***Total Consumption for Plinth Area of 1 000 m^2***
Solution with Termiticide (ℓ)	1 420	1 050	1 575	5 000	315	**9 360** ℓ
Chlorpyrifos 20 Percent EC (ℓ)	71.00	52.50	78.75	250.00	15.75	**468.00** ℓ
Imidachloprid 30.5 Percent SC (ℓ)	2.98	2.20	3.30	10.50	0.66	**19.64** ℓ
Bifenthrin 2.5 Percent EC (ℓ)	28.40	21.00	31.50	100.00	6.30	**187.20** ℓ

C-2 REINFORCED CEMENT CONCRETE FOUNDATION

C-2.1 Calculation for a Building of Size 50 m × 20 m at Plinth Level

a) Area of plinth is 50 m × 20 m, that is, 1 000 m^2;

b) Approximately 15 percent of the plinth area is covered by R.C.C. foundation; and

c) Assume total numbers of columns are 150 and the average size of R.C.C. column is approximately 0.5 m × 0.2 m.

C-2.2 The dosage/concentration ratio of respective termiticides are as follows:

a) Chlorpyrifos 20 percent EC — 50 ml chemical per 1 litre of water

b) Imidachloprid 30.5 percent SC — 2.1 ml chemical per 1 litre of water

c) Bifenthrin 2.5 percent EC — 20 ml chemical per 1 litre of water

C-2.3 The consumption of solution (chemical diluted with water) as well as the concentrated termiticides (recommended) will be as under:

C-2.3.1 *First Treatment – Backfill in Immediate Contact with Foundation*

1.4 m (peripheral length of each column) × 0.5 m (depth of treatment area from ground level) × 150 (no. of columns) × 7.5 litres per m^2 = 787.5 litres total consumption of solution.

NOTE — In case of masonry filling between the columns, the same may also be treated.

C-2.3.2 *Second Treatment – Junction of Wall and Floor*

For plinth area 50 m × 20 m, average peripheral length that is, 140 running metre × 1.5 m approximately (depth of walls below the plinth level is considered on average) × 7.5 litres per m^2 = 1 575 litres total consumption of solution.

C-2.3.3 *Third Treatment – Top Surface of Plinth Filling*

Total area of plinth (that is, 1 000 m^2) × 5 litres per m^2 = 5 000 litres total consumption of solution.

C-2.3.4 *Fourth Treatment – External Periphery*

For 50 m × 20 m plinth area, average peripheral length, that is, total 140 running metre, 140 × 0.3 (depth) × 7.5 litres per m^2 = 315 litres.

C-2.4 In line with the calculations in **C-2.3**, a summary of calculations with different chemicals is given below:

	First Treatment	***Second Treatment***	***Third Treatment***	***Fourth Treatment***	***Total Consumption for Plinth Area of 1 000 m^2***
Solution with Termiticide (ℓ)	787.5	1 575.0	5 000.0	315.0	**7 677.5** ℓ
Chlorpyrifos 20 percent EC (ℓ)	39.37	78.75	250.00	15.75	**383.87** ℓ
Imidachloprid 30.5 percent SC (ℓ)	1.65	3.30	10.50	0.66	**16.11** ℓ
Bifenthrin 2.5 percent EC (ℓ)	15.75	31.50	100.00	6.30	**153.55 ℓ**

C-3 PILE FOUNDATION

C-3.1 Calculation for a Building of Size 50 m x 20 m at Plinth Level

a) Area of plinth is 50 m × 20 m = 1 000 m^2; and
b) Assume total numbers of pile foundations/pile caps is 60 nos. and the average size of pile foundation/ pile cap is approximately 1.5 m × 1.5 m.

C-3.2 The concentration ratio of respective termiticides are as follows:

a) Chlorpyrifos 20 percent EC — 50 ml chemical per 1 litre of water
b) Imidachloprid 30.5 percent SC — 2.1 ml chemical per 1 litre of water
c) Bifenthrin 2.5 percent EC — 20 ml chemical per 1 litre of water

C-3.3 The consumption of solution (chemical diluted with water) as well as the concentrated termiticides (recommended) will be as under:

C-3.3.1 *First Treatment – Backfill Around R.C.C.*

Average peripheral length of foundation (that is, 140 m) x 2.0 m approximately (take actual depth of treatment area of backfill in immediate contact with RCC above raft up to finished ground level) × 7.5 litres per m^2 = 2 100 litres total consumption of solution.

C-3.3.2 *Second Treatment – External Periphery*

For 50 m × 20 m plinth area, average peripheral length, that is, total 140 running metre, 140 m × 0.3 m (depth) × 7.5 litres per m^2 = 315 litres.

C-3.4 In line with the calculations in **C-3.3**, a summary of calculations with different chemicals is given below:

C-4 BASEMENT (WITH THE RAFT FOUNDATION)

C-4.1 Calculation for a Building of Size 50 m × 20 m at Plinth Level

Area of plinth/basement is 50 m × 20 m = 1 000 m^2.

C-4.2 The dosage/concentration ratio of respective termiticides are as follows:

a) Chlorpyrifos 20 percent EC — 50 ml chemical per 1 litre of water
b) Imidachloprid 30.5 percent SC — 2.1 ml chemical per 1 litre of water
c) Bifenthrin 2.5 percent EC — 20 ml chemical per 1 litre of water

C-4.3 The consumption of solution (chemical diluted with water) as well as the concentrated termiticides (recommended) will be as under:

C-4.3.1 *First Treatment – Treatment of Plinth/Basement Excavation*

1 000 m^2 (total plinth/basement excavated soil surface area) × 5 litres per m^2 = 5 000 litres total consumption of solution.

C-4.3.2 *Second Treatment – Treatment for Filling around Retaining Walls of Basement*

For 50 m × 20 m plinth area, average peripheral length, that is, total 140 running metre.

The depth of actual basement/filled soil around basement retaining walls needs to be considered (the depth/height of basement may differ for different sites).

For example, if the depth is 5 metres:

140 running metre (periphery) × 5 m (depth) × 7.5 litres per m^2 = 5 250 litres total consumption of solution.

	First Treatment	***Second Treatment***	***Total Consumption for Plinth Area of 1 000 m^2***
Solution with Termiticide (ℓ)	2 100	315.0	**2 415** ℓ
Chlorpyrifos 20 percent EC (ℓ)	105.00	15.75	**120.75** ℓ
Imidachloprid 30.5 percent SC (ℓ)	4.41	0.66	**5.07** ℓ
Bifenthrin 2.5 percent EC (ℓ)	42.00	6.30	**48.30** ℓ

C-4.3.3 *Third treatment – Treatment for External Periphery*

For 50 m × 20 m plinth area, average peripheral length, that is, total 140 running metre.

140 m × 0.3 m (vertical 300 mm depth of basement shall be considered) × 7.5 litres per m^2 = 315.0 litres.

C-4.4 In line with the calculations in **C-4.3**, a summary of calculations with different chemicals is given below:

	First Treatment	***Second Treatment***	***Third Treatment***	***Total Consumption for Plinth Area of 1 000 m^2***
Solution with Termiticide (ℓ)	5 000	5 250	315	**10 565 ℓ**
Chlorpyrifos 20 percent EC (ℓ)	250	262.5	15.75	**528.25 ℓ**
Imidachloprid 30.5 percent SC (ℓ)	10.5	11.02	0.66	**22.18 ℓ**
Bifenthrin 2.5 percent EC (ℓ)	100	105	6.3	**211.3 ℓ**

ANNEX D

(*Informative*)

(*Foreword*)

COMPARATIVE STATEMENT OF TERMITICIDES

Name → / Property ↓	**Imidacloprid** 30.5 percent SC	**Chlorpyrifos** 20 percent EC	**Bifenthrin** 2.5 percent EC
Active ingredient	0.075 percent	1 percent	0.05 percent
Formulation	Suspension concentrate	Emulsifiable concentrate	Emulsifiable concentrate
Chemical classification	Neonicotinoids	Organo phosphates	Synthetic pyrethroids
Dilution per litre of water	2.1 ml (1 : 476)	50 ml (1 : 20)	20 ml (1 : 50)
Odour	No smell	Felt	Felt (aromatic hydrocarbon odour)
Type of termiticide	Non-repellent, but termites get affected	Repellent	Repellent

NOTES

1 The above is purely a general comparison of the three termiticides to serve only as a preliminary guide.

2 Users are suggested to examine the respective Material Safety Data Sheets (MSDS) of the termiticides from manufacturers for detailed information/comparison thereof, so as to make an informed choice for their project based on its location, size, soil type, amount of infestation, type of building, etc.

ANNEX E

(*Foreword*)

COMMITTEE COMPOSITION

Building Construction Practices Sectional Committee, CED 13

Organization	*Representative(s)*
In Personal Capacity (*Flat No. 2061, Engineers Apartments, Plot 11, Sector-18A, Dwarka, New Delhi 110078*)	Shri D. S. Sachdev (***Chairman***)
Ahluwalia Contracts (India) Limited, New Delhi	Shri Shobhit Uppal Shri Pradeep Kumar (*Alternate*)
Association of Consulting Civil Engineers (India), Bengaluru	Shri A .N. Prakash Shri Satish V. Salpekar (*Alternate*)
Bhabha Atomic Research Centre, Mumbai	Shri K. Srinivas Shri H. E. Iyer (*Alternate*)
Builders Association of India, Mumbai	Shri Surojit Samanta Shri Ram Avtar (*Alternate*)
Building Materials and Technology Promotion Council, New Delhi	Shri Chandi Nath Jha
CSIR-Central Building Research Institute, Roorkee	Shri S. K. Negi Dr Ajay Chourasia (*Alternate*)
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CSIR-Structural Engineering Research Centre, Chennai	Dr S. Saibabu Shri Farvaze Ahmed (*Alternate*)
Central Insecticides Board, Faridabad	Dr B. S. Phogat Dr J. P. Singh (*Alternate*)
Central Public Works Department, New Delhi	Shri Harish Kumar Shri Manoj Kumar (*Alternate*)
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Confederation of Real Estate Developers' Association of India, New Delhi	Representative
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Development Alternatives, New Delhi	Shri Ashok Khosla
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Indian Plywood Industries Research and Training Institute, Bengaluru	Shri Amitava Sil Shri Anand Nandanwar (*Alternate*)

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The All India Glass Manufacturers' Federation, New Delhi	Shri Sourabh Kankar Shri Rupinder Shelly (*Alternate*)
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The Energy Resources Institute, New Delhi	Shri Sanjay Seth Ms Megha Behal (*Alternate*)
In Personal Capacity [*Pratap Nursery Lane* (*Near Gurudwara*)*, Panditwari, Dehradun 248007*]	Shri K. S. Pruthi
BIS Directorate General	Shri Sanjay Pant, Scientist 'F' and Head (Civil Engineering) [Representing Director General (*Ex-officio*)]

Member Secretaries

Shri Arunkumar S.
Scientist 'E' (Civil Engineering), BIS

and

Shri Durgesh Kumar Patel
Scientist 'B' (Civil Engineering), BIS

Working Group on Anti-termite Measures in Buildings, CED 13/WG

Organization	*Representative(s)*
In Personal Capacity (*Flat No. 2061, Engineers Apartments, Plot 11, Sector-18A, Dwarka, New Delhi 110078*)	Shri D. S. Sachdev (***Convener***)
Bhabha Atomic Research Centre, Mumbai	Shri K. Srinivas Shri H. E. Iyer (*Alternate*)
Central Insecticides Board, Faridabad	Dr B. S. Phogat Dr J. P. Singh (*Alternate*)
CSIR- Central Building Research Institute, Roorkee	Shri S.K. Negi Dr Ajay Chourasia (*Alternate*)
Central Public Works Department, New Delhi	Shri Manoj Kumar Sharma Shri Amar Singh (*Alternate*)
Indian Pest Control Association, New Delhi	Vice President Secretary (*Alternate*)
Paramount Pest Consultants, Pune	Dr Sarang Savalekar

(*Continued from second cover*)

c) An informative annex on comparative statement of termiticides with respect to their properties has been included as Annex D.

d) References to Indian Standards have been updated.

The provisions of this standard are without prejudice to the various Acts, Rules and Regulations including the *Insectides Act*, 1968 and the Rules framed thereunder.

The composition of the Committee responsible for the formulation of this standard is given in Annex E.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
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